Geospatial Learning Pathways Presentation

Introduction to ArcGIS ModelBuilder

by

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This is a BLM Geospatial Learning Pathways presentation. Introduction to ArcGIS ModelBuilder is presented by the Montana State Office. You'll see an overview of the Modelbuilder menu toolbar and a software demonstration on how to build a model. Your presenter is Shelley Johnson of the Montana State Office.

I'm going to go over what ModelBuilder is and how to create models today.

First thing, what is Modelbuilder? It's basically a graphical environment to set up a geoprocessing work flow, a user-friendly way to automate a series of tools and a part of ArcGIS processing framework. What is a model? A model is what you create within ModelBuilder. It's in ArcGIS. It's a process or sequence of processes that you connect together in ModelBuilder. It's a way of automating work flows by creating tools. And why would you build a model? You build a model to automate geoprocessing work flows. It gives you an ability to share geoprocessing work. You can create custom tools with ModelBuilder. It is easy to run and re-run tools that you've created multiple times on multiple different data sets. And it is a visual representation of geoprocessing.

How do I access ModelBuilder? The screen shots that I'm showing you right now are actually [ArcGIS] 9.3. In 9.3, they [ESRI] moved ModelBuilder a little bit and gave you an icon on both of the toolbars, the standard toolbars. This is your ModelBuilder toolbar in ArcMap and this is your ModelBuilder toolbar in ArcCatalog. Before, in 9.2, if you wanted to get to ModelBuilder, you would open ArcToolbox and then right-click on a toolbox and you would be able to open a model.

Once you open ModelBuilder, there's five pull down menus on the main menu. The first one is the Model menu. It gives you the options for running your tool, validating your model, view your messages. You save, you can print, you can import, export, and it also gives you the option to close the model. You can also use this menu to delete you immediate data and set your model properties.

The next pull down menu is your Edit menu. That's the generic cut, copy, paste, delete, and select that you have on most of your applications.

The next one is the View pull down and that contains an auto layout option and you can set different settings in there to display your model. It also contains options for zooming in or out, edit, copy, paste.

The next one is your Window pull down. The window pull down contains an overview window you can use to display the entire model when you zoom in on certain parts of it. It's kind of like in ArcMap when you use the over view window. You can see the entire extent in the over view window, but you're zoomed in, in your view window.

And then we have the Help. And that is your basic help menu. It gives you access to the ArcGIS desktop and the about ModelBuilder box.

Then we have the ModelBuilder toolbar. This is the toolbar that is right beneath the menu pull down on your ModelBuilder. So, up close, this is what they are. We have the save, the print, cut, copy, paste. Those are pretty generic tools. And we have the add data button, which is the same add data button that we use ArcMap. You can add data the same way in ModelBuilder. You can click on the button and browse to the folder you want to add the data from. Or you can drag the data and drop it from the tools, or the data, from ArcMap or ArcCatalog.

Then we have the Auto Layout button. And that button will automatically - if you click that button, once you bring your tools in it, it will automatically lay them out in a pleasing manner. It just takes them and groups them altogether and put them in - so they're not all scattered around.

Then we have the Zoom to Full Extent; the Zoom Ins and Outs and all those. Those are all the same as in Arc. The Select Element is the same. You just select an element within your model and you can edit it or make changes to the properties.

Then we have the Connect button. The connect button is what connects one tool within your model to another tool.

And then the last button is the Run button and once you've got your tool or your model built and to the point where you want to try and run it to see if it works, that's the button that you would use to run the tool.

Now we get in to creating the model. First thing you do before you can create a model, is you have to have a toolbox to store it in. The default toolbox folder is stored on the C-drive in documents and settings. But, since we're on the Citrix environment, we can't use the C-drive. So, you need to create a folder on your X-drive and you can name it whatever you want; the default is called My Toolboxes. But you can name it whatever you want. And, once you've created the folder, you need to set the location of that folder in your tools menu so that ModelBuilder can find it. So what you need to do, to do that, is click on your tools menu on ArcMap or ArcCatalog and click on the options tool. Then you can select the geoprocessing tab, like I said, it defaults to your documents and settings. So here you would click on the browse window, or the browse button, and go to your X-drive and find the folder that you created to house your toolboxes. If don't have a folder on there, and you type one in, it will accept that folder, but if it really doesn't exist, nothing will happen with your tools. They won't go anywhere. So, this is something that has to be done by everyone before they create a model in order for it to work correctly.

Then, after you create a folder for your tool box, you have to create a toolbox. A model is stored within a toolbox. In the graphic below, it shows you ArcToolbox. Create a new toolbox by right-clicking on the ArcToolbox name itself. And it gives you the option to do a new toolbox or add a toolbox or a couple other ones. But you would just say new toolbox and then it creates a new toolbox and adds it to your ArcToolbox window. So, it's created for you, but where's it created? Does anyone have any idea where it got created at? It gets created in the folder that we just created back in ArcCatalog. If you don't do that, it won't go anywhere.

The next thing you do after creating your toolbox is to create the actual model. You go in and you find the toolbox that you created, you right-click on it and you say new and then it gives you the option to select a couple of different things and you would select the model option.

Now, I'm going to give you a software demo and show you the steps that I just went through so you can see how you create a model.

This is ArcCatalog 9.2, it is not 9.3 so there will be a few things that are not the same once we get to 9.3, but for the most part, it's pretty much the same. There is no ModelBuilder tool in 9.2.

The first thing that we would need to do is go into the tool, go to the Options, and we would find our geoprocessing tab. I want to specify the location of my toolbox and folder, so I'm going to click on it. I'm going to go to my X-drive, now I'm going to create on a toolbox folder. This is where my location of my toolbox is going to be from this point on.

Okay, now that we have done that, we can open up toolbox. There's another way to show toolbox if you don't like docking toolbox; you can dock it, it doesn't have to be docked within ArcCatalog. It can be docked outside of ArcCatalog, but also if you go to Tools and Options again, go to the general tab on the top level entry. If you want to see toolboxes show up in the Table of Contents, you click that and it makes them a lot more accessible than having to open the toolbox from here every time. It also shows you your toolboxes and the system toolboxes. These are the regular tools that you see everyday when you open ArcToolbox in ArcGIS. This one is my toolbox and I don't have any tools in it because I just created it. So, at this point, what I would want to do is create a tool so I could store my model. So it creates a toolbox for you and you can name it whatever you want to name it. And once you have a toolbox, you have a place to store a model. At this point, you would create or you would right-click on test, say new, and click model. This opens up the ModelBuilder window. This is, these are the pull downs we went through and this is the toolbar that I showed you in powerpoint.

Let's make a model. First thing you want to do is pull in a tool. Your model is basically pulling a tool to use for repetitive processes for things that you want to share with other users. There's a lot of different reasons to create tools. I use them a lot, personally, for data. I do a lot of data clean up, a lot of data merging, and that kind of thing with tools and models. So, I use a lot of models so I don't have to sit there and do all of the processes manually each time.

I'm going to grab a merge tool just to show you an example. I just went into toolbox, found the tool that I wanted and I just dragged it over and dropped it into the model. When you first bring it in, it's empty. There's nothing in it but an empty tool. This is called a not ready to run state in ModelBuilder. There's three states, not ready to run, ready to run, and already been run. This is the not ready to run state and it's not ready because we don't have any parameters in it; we just have a tool. So if we double-click on the tool itself, you get a window. This lets you fill out the rest of your tool.

So I'm going to go in and I'm going to input a couple of data sets that I want to merge together. I'm picking on Dillon today. I'm adding some fire parameters and I'm also going to go over to Central Zone and I'm going to grab some prior parameters from them. It asks you for an output

data set. I don't want to store it in the Dillon file, so I'm going to give it a different output. And I'm going to save that. And then you can choose to delete any of the attributes if you don't want them in there if you want to do that. I'm not going to do that at this point. So, now I'm going to click ok and it populates my model. It populated it with both of my inputs, my tool, and the output from the tool.

So, I go up here and I click on the auto layout button. It puts the model into the standard format. Now we have a model that is in the ready to run state and the way you can tell is that all of your boxes within the tool are filled in. At this point, you can run the model and test it and see what happens. As it's going through the model, it highlights the tool that it's doing. And this is what happens; I'm not sure why it didn't work. Non-numeric, hmmm.

Voice: Shelley, do the data sets have to be exactly the same to merge?

Shelley: No. They don't. But you will get empty attributes for the ones that don't match up. But, you know, I knew that would happen with this, I just --- it was no big deal for the test. But normally you would want to check your attributes before you merged stuff together like that. Just as you would if you were just using the regular merge tool.

This worked when I tested it. So I'm not sure why it's not working now. I'll try and run it again and see what happens, if it bombs again. Yeah, I'm not sure. Feature 10, Feature 8…

Let's try this and see if it works. Now, you can see what happened. I took out two parameters and I put two new ones in. It did not delete the ones that I took out; it just simply disconnected them from the model. So, at this point, I can take them out, or I can leave them in if I think I might want to use them down the road. They will not be part of the model if you run the model. But, let's go ahead and try it again and see what happens this time. Okay, this time the model worked. So, if we go to our training folder. I did get a shapefile. Looks like I got one the first time, too. That's interesting.

Now, the model is in a already been run state. The shadows that you see here tell you that the model has already been run. If you go back to model and you do validate entire model, it will run through your model and it will make it so your model is ready to run again.

If you right-click on different symbols in your ModelBuilder, you have different options. You can display properties, you can change colors. I don't like green so I'm going to change it. You can

do that kind of stuff. You can create variables for your tool. You can create labels for your tool if you want a label. So when you are passing these tools around to other users, if it's not just going to be you using them, you can label them so it's easier for people to know what your tool is going to do. And it works just like - double-click on it, yeah - then you can type in. Identify your tools and data sets. You can do the same thing on your data sets and I can let everyone know this is my 24K index. Then you can take your label and you can move it anywhere you want. And it still stays connected to that. Save file.

There are, white properties -or, let's see - switch the picture symbol. I can switch my symbol within ModelBuilder to show a picture instead of a shape; if I can find a picture. That's a picture of a toolbar. But you can take any image file that you would want, if you had a reason to store an image file. Take a graphic of your 24K index file and store that instead of a shape or the monument boundary or something like that, if you wanted to make it a little more graphic.

There are other options, if you go to the Properties box, you have environment settings that you can set and you have pre-conditions that you can set if you have variables set. You can export your models to a graphic or to a script. You can import models. You can do a report on your model. You can view a report in the window or you can send it to a file and what that does is it gives you a report on your data, where it came from, your output, and the processes that you used. So, you can see a lot of information about your models just by clicking on a report. You can copy, you can cut, you can delete. You can do a lot of the standards, you know, rename, all that kind of stuff in here as well as in Arc. That's pretty much - you can save your model. Once you save it, it will be saved to the toolbox that you created it in. If you want to rename it, you go to your toolbox and right-click and rename it to whatever you want to name your model.

So, that's it for the introduction to ModelBuilder. Just a brief overview on what it's all about. There are a couple of [ESRI] virtual campus sessions that you can take if you want to take some more training on it or get into it a little bit more. There's a real good one hour virtual campus session. It just goes through the basics - goes through a lot more than what I just went through, but it's still only a one hour - gives you just an overview of all of the different things that you can do in ModelBuilder. There's also a 15-hour self-study virtual campus class. That is geoprocessing and includes the ModelBuilder in it as well. So, those are a couple other options for you to take if you're interested in more ModelBuilder training.

Shelley: Anybody have any questions? Scott, I see your hand up here.

Scott: Hey Shelley. What about if we want to share our models with others?

Shelley: You can share your models. There is - should've showed you - there's a documentation feature in ModelBuilder which really needs to be filled out if you do share you model. It gives you properties of your model, the name, when it was created, all your parameters, and that kind of stuff. So, anybody else that's using your model will be able to tell how you created it and how they can modify it if they need to. So, you can share a model with anyone you want, but there's certain things you need to be aware of. So, also depends on how you created the model; there may some parameters that need to be changed. You've also got a toolbox on the State Office folder on the P-drive that has some tools that I created for a couple different users. So those are stored in a toolbox on the P-drive. So you can take them and move them around and make them accessible to other users.

Question: What online courses are available through the ESRI Virtual Campus?

Shelley: There's a list on the (ESRI website), I believe it's on the one of the first pages on the virtual campus and it gives you a list of all of the BLM approved free virtual campus classes and Diane (Diane Nelson at NTC) is the one you need to go through for those (access codes).

Shelley: Dennis, did you have a question?

Dennis: Yeah, I did. How complex can you make these models, Shelley?

Shelley: Oh, really, really, really complex.

Dennis: So you could take something, let's say you wanted to sort or query and you were going to do this to a bunch of different databases, you could do your query based on this thing and you could merge that with the other table that you wanted to merge it with and then you could run a, you know, some kind of mathematical formula on that and come out with another output. Will it do all that kind of stuff?

Shelley: Yep. You can do a real simple model or you can do an incredible model. They've got some extremely large models out there that are pretty wild.

Dennis: On some level it could be - it's like writing script?

Shelley: Yes. It is very much like writing script. In fact, if you can think of it like that, it makes it a lot easier because it's basically just a graphic representation of a script. So, I built one that I used to merge all of the NHD data sets together and they all came by county, by shapefile, for each different layer. So, I had 3 states worth of counties and six or eight layers for each one of them to do. I think I had about, it's close to, 200 inputs for the merge on each one of them.

Dennis: Did it take you awhile to debug that?

Shelley: It took me awhile just to get them all in there. Once I got them all in it was really pretty simple because it was a very simple model. It was just like the one I showed you, except for it had multiple input and there's a way to do that real easily too that you can add them in on a form rather than adding each one as a separate symbol. You can do it either way, but there's an easier way to do it. So you have one symbol for your input and it just takes a group of data and puts it all together for you. But, it did take awhile to get it figured out.

Lori: Shelley, this is Lori. We were wondering if you have a complex model with multiple steps in it, do you have to create or does it automatically create an output file after each step? Or when you're building this model, can you do, like, the merge and then a clip, and then an intersect, or exactly - we're not exactly sure how that would work?

Shelley: You can do, yeah, you would do a merge and then you would take that output and you would clip it and then you take that output and you would whatever. Yeah, you can group them all together, so when you run it, it does all of those processes in one step. You just have to figure out how to put your tools together to make it run right. There's also an intermediate data step where it will go and it will create a shapefile for you for whatever process was that you asked for. And then it will take that shapefile and run it against something else to create another shapefile and those intermediate shapefiles that you don't really want to keep, you can right-click on the symbol in ModelBuilder and check intermediate data and once you're tool is run, you can go back to your auto pull down and click delete intermediate data and it will get rid of all of that, those intermediate shapefiles and stuff that you've created along the way.

Thanks, Shelley.

You bet.

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